Champion Engineering Specifications

General

Fiberglass Conduit Specifications for Use Below Ground

The conduit shall be fiberglass conduit, also known as Reinforced Thermosetting Resin Conduit (RTRC), manufactured using the **single-circuit filament winding process**. Multi-circuit windings are not allowed. The conduit shall have a winding angle as close as possible to 54.75°.

- The resin system shall be epoxy based, with no fillers, using an anhydride curing agent. The fiberglass shall consist of continuous **E-glass "Grade A" roving**.
- The conduit shall not contain any halogen compounds containing chlorine, bromine, fluorine and iodine in more than trace amounts when burning.
- Conduit and elbows shall be manufactured from the same resin/hardener/glass systems manufactured by the same filament wound system.
- Fiberglass conduit fittings and accessories shall be manufactured using one of two manufacturing procedures.
  - The first method shall use the same process, methods and components as used to manufacture the fiberglass conduit.
  - The second method shall use the compression molding process, Sheet Molding Compound (SMC), for the manufacture of the finished component. The SMC material shall be a vinyl ester resin with +30% reinforcement of glass. The glass fibers should be approximately 1" in length. The SMC material shall be fire resistant to UL 2515.
- Conduit shall be integral bell and spigot or bonded coupling and spigot.
- Conduit, elbows and fittings are specified for use throughout a temperature range of -60°F (-51°C) to 250°F (121°C).
- Manufacturer shall have a current Certificate of Compliance, issued by an independent and accredited company, with an **ISO 9001: 2008 Quality Management System**.

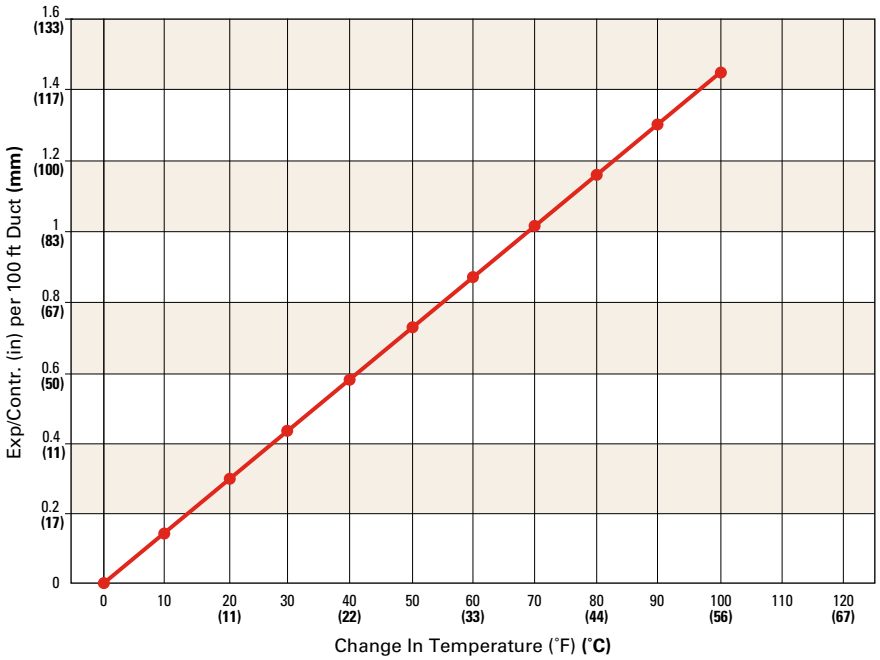
Electrical Characteristics

Volume Resistivity	3.8 x 10^{14} ohm-cm	ASTM D257
Surface Resistivity	1.1 x 10^{14} ohms	ASTM D257
Dielectric Constant	3.5 (at 10^{3} cps)	ASTM D150
Dissipation Factor	0.005 (at 10^{3} cps)	ASTM D150
Dielectric Strength	500 volts/mil (19.7 kv/mm)	ASTM D149

Physical and Mechanical Characteristics

Tensile Strength, Axial	11,000 psi (76 MPa)	ASTM D2105
Compressive Strength, Axial	12,000 psi (83 MPa)	ASTM D695
Ultimate Elongation	2% psi (9.6 GPa)	ASTM D2105
Modulus of Elasticity (4" conduit)	1.4 x 10^{+6} psi (9.6 GPa)	ASTM D2105
Thermal Conductivity	2.0 Btu.in/ft².hr.°F (0.30 W/m.K)	ASTM D5930-1

Specific Gravity	1.9	ASTM D792
Glass Content	70% + 5%	API SPEC 15LR
Water Absorption	Less than 1%	ASTM D570
Barcol Hardness	54 + 2	ASTM D2583
Flammability Above Ground Conduit Below Ground Conduit	Conform to UL 2515 and CSA C22.2 HB Rating	No 211.3-96 UL 94
Coefficient of Thermal Expansion	1.2 x 10-5 in/in/°F (2.2 x 10-5 m/m/°C)	ASTM D696



Heat Distortion

The minimum heat distortion temperature shall be 230°F (110°C) when tested at 264 psi in accordance with ASTM D 648.

Joint Pullout

A 12-inch length shall be cut from both the belled end and spigot end of a length of conduit. The two parts shall be assembled in accordance with Champion's instructions. The assembly shall be tested in accordance with ASTM D 2105 and shall meet the requirements of the table below.

JOINT PULLOUT RESISTANCE / MINIMUM FORCE – LBS (N)							
NOMINAL SIZE	INTERFERENCE JOINT		GASKET WITH INTERFERENCE JOINT		GASKET WITHOUT INTERFERENCE JOINT		TIGHT LOCK JOINTS (ADHESIVE)
All	1,000	**(4,450)**	2,000	**(8,900)**	500	**(2,220)**	11,000 psi x (cross sectional area of conduit)

Toxicity

Champion Duct conduit does not contain any compounds that can release halogens – bromine or chlorine – when burning.

GASES	VALUES (MAX PPM)
Hydrogen Chloride	0
Hydrogen Bromide	0
Hydrogen Cyanide	<1
Hydrogen Sulfide	0
Ammonia	0
Aldehydes as HCHO	<10
Oxides of Nitrogen	<50
Carbon Dioxide	<12,500
Carbon Monoxide	<250

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Surface Finish

- Exterior Surface: Normally less than 2,000 microinches (50.8 micron)
- Interior Surface: Normally less than 125 microinches (3.2 micron)

Available Colors

Standard colors are black and dark grey. Other optional colors are available. These include red, orange, blue and white, and additional colors beyond these options are also available as well. Contact Champion Fiberglass for additional information regarding colors.

Water Tightness

There should be no evidence of water leakage through the joint when tested in accordance to UL 2515 and CSA C22.2 No. 2515. In order to achieve water tightness use Champion Mix® or Epoxy Adhesive Kit for Tight Lock Joint.

Coefficient of Friction

The following data for static coefficient of friction is for dry conduit and non-lubricated cable at a temperature of 72°F (22°C).

CABLE MATERIAL	CONDUIT MATERIAL					
	EPOXY FIBERGLASS CONDUIT	PVC CONDUIT	STEEL CONDUIT	ALUMINUM CONDUIT	CONCRETE CONDUIT	POLYETHYLENE CONDUIT
PVC	0.38	0.90	0.57	0.61	0.95	1.90
XLP (Cross-linked Polyethylene)	0.23	0.90	0.75	1.50	0.75	2.00
LDPE (Polyethylene)	0.25	0.50	0.50	0.62	0.60	1.70
Neoprene	0.53	2.60	1.60	0.26	1.35	3.30
Concentric Neutral	0.16	–	–	–	–	–
Tech (Armored) Cable	0.16	2.60	1.60	0.26	1.35	3.30

Impact Resistance

The minimum impact resistance values for the conduit shall be as shown in the table below when tested in accordance with ASTM D2444.

NOMINAL SIZE	AT 73.4°F (23°C) IMPACT RESISTANCE LBS/FT (NM)								AT 32°F (0°C) IMPACT RESISTANCE LBS/FT (NM)							
	SW		MW		HW		XW		SW		MW		HW		XW	
3/4"	20	**(27)**	–	–	–	–	150	**(202)**	20	**(27)**	–	–	–	–	150	**(202)**
1"	25	**(34)**	–	–	–	–	400	**(540)**	25	**(34)**	–	–	–	–	400	**(540)**
1-1/4"	30	**(41)**	–	–	–	–	400	**(540)**	30	**(41)**	–	–	–	–	400	**(540)**
1-1/2"	35	**(47)**	–	–	–	–	500	**(675)**	35	**(47)**	–	–	–	–	500	**(675)**
2"	40	**(54)**	–	–	–	–	550	**(742)**	40	**(54)**	–	–	–	–	550	**(742)**
2-1/2"	55	**(75)**	–	–	–	–	600	**(810)**	55	**(75)**	–	–	–	–	600	**(810)**
3"	70	**(95)**	–	–	–	–	700	**(945)**	70	**(95)**	–	–	–	–	700	**(945)**
3-1/2"	80	**(108)**	–	–	–	–	850	**(1,150)**	80	**(108)**	–	–	–	–	850	**(1,150)**
4"	85	**(115)**	–	–	120	**(163)**	1,000	**(1,350)**	85	**(115)**	–	–	120	**(163)**	1,000	**(1,350)**
5"	110	**(149)**	140	**(190)**	160	**(217)**	1,200	**(1,620)**	110	**(149)**	140	**(190)**	160	**(217)**	1,200	**(1,620)**
6"	130	**(176)**	160	**(217)**	200	**(271)**	1,300	**(1,755)**	130	**(179)**	160	**(217)**	200	**(271)**	1,300	**(1,755)**

For high-impact situations as well as during cold weather, PVC can shatter and/or flatten.

For high-impact, steel conduit will collapse and can pinch the cable. This will make repair of damaged conduit more difficult.

XW conduit has the highest impact value of all conduit materials available. If impacted, it will flex back close to its original diameter. SW, MW and HW will also flex back similarly after impact. They will not shatter.

Stiffness

The minimum conduit stiffness at 5% deflection for all sizes of conduit shall not be less than the values given in table below when tested in accordance with ASTM D2412.

PIPE STIFFNESS (PS) = (F/ΔY)																
NOMINAL SIZE	AT 73.4°F (23°C) LBF/IN² (MPA)								AT 32°F (0°C) LBF/IN² (MPA)							
	SW		MW		HW		XW		SW		MW		HW		XW	
3/4"	1,500	(10.3)	–	–	–	–	2,500	(17.5)	1,500	(10.3)	–	–	–	–	2,500	(17.5)
1"	1,200	(8.3)	–	–	–	–	2,400	(16.8)	1,200	(8.3)	–	–	–	–	2,400	(16.8)
1-1/4"	850	(5.9)	–	–	–	–	2,100	(14.7)	850	(5.9)	–	–	–	–	2,100	(14.7)
1-1/2"	600	(4.1)	–	–	–	–	2,000	(14)	600	(4.1)	–	–	–	–	2,000	(14)
2"	320	(2.2)	–	–	–	–	1,300	(9.0)	320	(2.2)	–	–	–	–	1,300	(9.0)
2-1/2"	200	(1.4)	–	–	–	–	800	(5.6)	200	(1.4)	–	–	–	–	800	(5.6)
3"	140	(1.0)	–	–	–	–	600	(4.1)	140	(1.0)	–	–	–	–	600	(4.1)
3-1/2"	85	(0.6)	–	–	–	–	450	(3.1)	85	(0.6)	–	–	–	–	450	(3.1)
4"	50	(0.3)	–	–	130	(0.7)	250	(1.7)	50	(0.3)	–	–	130	(0.7)	250	(1.7)
5"	40	(0.3)	75	(0.5)	90	(0.6)	180	(1.2)	40	(0.3)	75	(0.5)	90	(0.6)	180	(1.2)
6"	30	(0.2)	55	(0.4)	65	(0.4)	150	(1.0)	30	(0.2)	55	(0.4)	65	(0.4)	150	(1.0)

PVC Conduit
PVC conduit will stay compressed if it is crushed. (Same for steel conduit.)

Fiberglass Conduit
Epoxy Fiberglass conduit will flex back to almost its original shape after crushing.

Wire Fill

Maximum allowable percentage wire fill per National Electric Code.

IPS SIZES											
TRADE SIZE		INTERNAL DIAMETER		TOTAL AREA		PERCENT OF CROSS SECTION OF CONDUIT AND TUBING FOR CONDUCTORS					
						1 WIRE 53%		2 WIRE 31%		OVER 2 WIRE 40%	
		IN	(MM)	IN²	(MM²)	IN²	(MM²)	IN²	(MM²)	IN²	(MM²)
3/4"	(19)	0.910"	(23)	0.650"	(419)	0.345"	(222)	0.202"	(130)	0.260"	(168)
1"	(25)	1.175"	(30)	1.084"	(697)	0.574"	(370)	0.336"	(216)	0.434"	(279)
1-1/4"	(32)	1.520"	(39)	1.815"	(1,170)	0.962"	(620)	0.563"	(363)	0.726"	(468)
1-1/2"	(38)	1.760"	(45)	2.433"	(1,569)	1.289"	(832)	0.754"	(486)	0.973"	(628)
2"	(51)	2.235"	(57)	3.923"	(2,525)	2.079"	(1,338)	1.216"	(783)	1.569"	(1,010)
2-1/2"	(64)	2.740"	(70)	5.896"	(3,805)	3.125"	(2,016)	1.828"	(1,179)	2.359"	(1,522)
3"	(76)	3.360"	(85)	8.867"	(5,715)	4.699"	(3,029)	2.749"	(1,772)	3.547"	(2,286)
4"	(102)	4.320"	(110)	14.657"	(9,452)	7.768"	(5,009)	4.544"	(2,930)	5.863"	(3,781)
5"	(127)	5.380"	(137)	22.733"	(14,677)	12.048"	(7,779)	7.047"	(4,550)	9.093"	(5871)
6"	(152)	6.435"	(163)	32.523"	(20,970)	17.237"	(11,114)	10.082"	(6,501)	13.009"	(8,388)

ID SIZES											
TRADE SIZE		INTERNAL DIAMETER		TOTAL AREA		PERCENT OF CROSS SECTION OF CONDUIT AND TUBING FOR CONDUCTORS					
						1 WIRE 53%		2 WIRE 31%		OVER 2 WIRE 40%	
		IN	(MM)	IN²	(MM²)	IN²	(MM²)	IN²	(MM²)	IN²	(MM²)
2"	(51)	2.000"	(51)	3.142"	(2,027)	1.665"	(1,074)	0.974"	(628)	1.257"	(811)
2-1/2"	(64)	2.500"	(64)	4.909"	(3,167)	2.602"	(1,678)	1.522"	(982)	1.963"	(1,267)
3"	(76)	3.000"	(76)	7.069"	(4,560)	3.746"	(2,417)	2.191"	(1,414)	2.827"	(1,824)
3-1/2"	(89)	3.500"	(89)	9.621"	(6,207)	5.099"	(3,290)	2.983"	(1,924)	3.848"	(2,483)
4"	(102)	4.000"	(102)	12.566"	(8,107)	6.660"	(4,297)	3.896"	(2,513)	5.027"	(3,243)
5"	(127)	5.000"	(127)	19.635"	(12,668)	10.407"	(6,714)	6.087"	(3,927)	7.854"	(5,067)
6"	(152)	6.000"	(152)	28.274"	(18,241)	14.985"	(9,668)	8.765"	(5,655)	11.310"	(7,297)

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Conduit Conductor Fill

Based on Wire Fill Data as outlined in the national electric code.

RHW

IPS SIZES												
TRADE SIZE		ALLOWABLE CONDUIT IN²	MAX 1 CONDUCTOR SIZE	IN² OF 1 CONDUCTOR	ALLOWABLE CONDUIT IN²	MAX 2 CONDUCTOR SIZE	IN² OF 2 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 3 CONDUCTOR SIZE	IN² OF 3 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 4 CONDUCTOR SIZE	IN² OF 4 CONDUCTORS
3/4"	**(19)**	0.345"	3/0	0.3117"	0.202"	4	0.1946"	0.260"	6	0.2178"	0.260"	8	0.2223"
1"	**(25)**	0.575"	300	0.5281"	0.336"	2	0.2666"	0.434"	2	0.3999"	0.434"	4	0.3893"
1-1/4"	**(32)**	0.962"	500	0.7901"	0.563"	2/0	0.5248"	0.726"	1/0	0.6669"	0.726"	2	0.5333"
1-1/2"	**(38)**	1.289"	800	1.2272"	0.754"	4/0	0.7435"	0.973"	3/0	0.9352"	0.973"	1/0	0.8891"
2"	**(51)**	2.079"	1250	1.8602"	1.216"	350	1.1917"	1.569"	250	1.3789"	1.569"	4/0	1.4871"
2-1/2"	**(64)**	3.125"	2000	2.7818"	1.828"	500	1.5802"	2.359"	400	1.9856"	2.359"	300	2.1124"
3"	**(76)**	4.699"	–	–	2.749"	900	2.7121"	3.547"	750	3.4955"	3.547"	500	3.1605"
4"	**(102)**	7.768"	–	–	4.544"	1500	4.3389"	5.863"	1250	5.5807"	5.863"	900	5.4243"
5"	**(127)**	12.048"	–	–	7.047"	2000	5.5636"	9.093"	2000	8.3455"	9.093"	1750	9.9091"
6"	**(152)**	17.237"	–	–	10.082"	–	–	13.009"	–	–	13.009"	2000	11.1273"

RHW

ID SIZES												
TRADE SIZE		ALLOWABLE CONDUIT IN²	MAX 1 CONDUCTOR SIZE	IN² OF 1 CONDUCTOR	ALLOWABLE CONDUIT IN²	MAX 2 CONDUCTOR SIZE	IN² OF 2 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 3 CONDUCTOR SIZE	IN² OF 3 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 4 CONDUCTOR SIZE	IN² OF 4 CONDUCTORS
2"	**(51)**	1.665"	1000	1.4784"	0.974"	250	0.9193"	1.257"	4/0	1.1153"	1.257"	3/0	1.2469"
2-1/2"	**(64)**	2.602"	1750	2.4773"	1.522"	400	1.3237"	1.963"	350	1.7875"	1.963"	250	1.8385"
3"	**(76)**	3.746"	2000	2.7818"	2.191"	600	1.9459"	2.827"	500	2.3704"	2.827"	400	2.6475"
3-1/2"	**(89)**	5.099"	–	–	2.983"	900	2.7121"	3.848"	800	3.6816"	3.848"	500	3.1605"
4"	**(102)**	6.660"	–	–	3.896"	1250	3.7205"	5.027"	1000	4.4353"	5.027"	800	4.9087"
5"	**(127)**	10.407"	–	–	6.087"	2000	5.5636"	7.854"	1750	7.4319"	7.854"	1250	7.4409"
6"	**(152)**	14.985"	–	–	8.765"	–	–	11.310"	2000	8.3455"	11.310"	2000	11.1273"

THHN

IPS SIZES												
TRADE SIZE		ALLOWABLE CONDUIT IN²	MAX 1 CONDUCTOR SIZE	IN² OF 1 CONDUCTOR	ALLOWABLE CONDUIT IN²	MAX 2 CONDUCTOR SIZE	IN² OF 2 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 3 CONDUCTOR SIZE	IN² OF 3 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 4 CONDUCTOR SIZE	IN² OF 4 CONDUCTORS
3/4"	**(19)**	0.345"	4/0	0.3237"	0.202"	3	0.1946"	0.260"	4	0.2472"	0.260"	6	0.2028"
1"	**(25)**	0.575"	350	0.5242"	0.336"	1	0.3124"	0.434"	2	0.3474"	0.434"	3	0.3892"
1-1/4"	**(32)**	0.962"	600	0.8676"	0.563"	3/0	0.5358"	0.726"	2/0	0.6669"	0.726"	1	0.6248"
1-1/2"	**(38)**	1.289"	900	1.2311"	0.754"	4/0	0.6474"	0.973"	4/0	0.9711"	0.973"	2/0	0.8892"
2"	**(51)**	2.079"	1000	1.3478"	1.216"	400	1.1726"	1.569"	300	1.3824"	1.569"	4/0	1.2948"
2-1/2"	**(64)**	3.125"	–	–	1.828"	600	1.7352"	2.359"	500	2.1219"	2.359"	400	2.3452"
3"	**(76)**	4.699"	–	–	2.749"	1000	2.6956"	3.547"	800	3.3255"	3.547"	600	3.4704"
4"	**(102)**	7.768"	–	–	4.544"	–	–	5.863"	1000	4.0434"	5.863"	1000	5.3912"
5"	**(127)**	12.048"	–	–	7.047"	–	–	9.093"	–	–	9.093"	–	–
6"	**(152)**	17.237"	–	–	10.082"	–	–	13.009"	–	–	13.009"	–	–

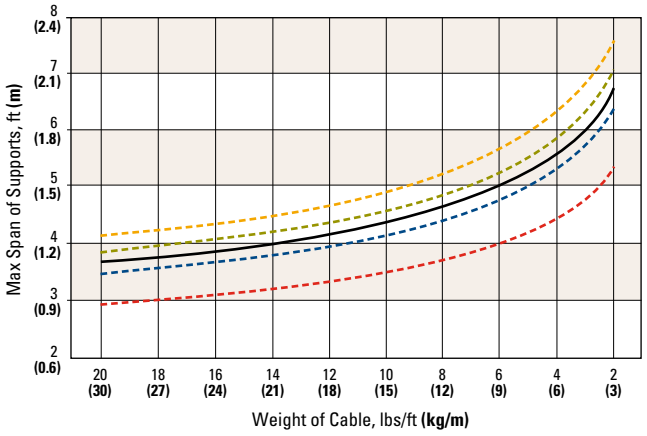
THHN

ID SIZES												
TRADE SIZE		ALLOWABLE CONDUIT IN²	MAX 1 CONDUCTOR SIZE	IN² OF 1 CONDUCTOR	ALLOWABLE CONDUIT IN²	MAX 2 CONDUCTOR SIZE	IN² OF 2 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 3 CONDUCTOR SIZE	IN² OF 3 CONDUCTORS	ALLOWABLE CONDUIT IN²	MAX 4 CONDUCTOR SIZE	IN² OF 4 CONDUCTORS
2"	**(51)**	1.665"	1000	0.3237"	0.974"	300	0.9216"	1.257"	250	1.1910"	1.257"	3/0	1.0716"
2-1/2"	**(64)**	2.602"	–	–	1.522"	500	1.4146"	1.963"	400	1.7589"	1.963"	300	1.8432"
3"	**(76)**	3.746"	–	–	2.191"	750	2.0992"	2.827"	600	2.6028"	2.827"	400	2.3452"
3-1/2"	**(89)**	5.099"	–	–	2.983"	1000	2.6956"	3.848"	900	3.6933"	3.848"	600	3.4704"
4"	**(102)**	6.660"	–	–	3.896"	–	–	5.027"	1000	4.0434"	5.027"	900	4.9244"
5"	**(127)**	10.407"	–	–	6.087"	–	–	7.854"	–	–	7.854"	1000	5.3912"
6"	**(152)**	14.985"	–	–	8.765"	–	–	11.310"	–	–	11.310"	–	–

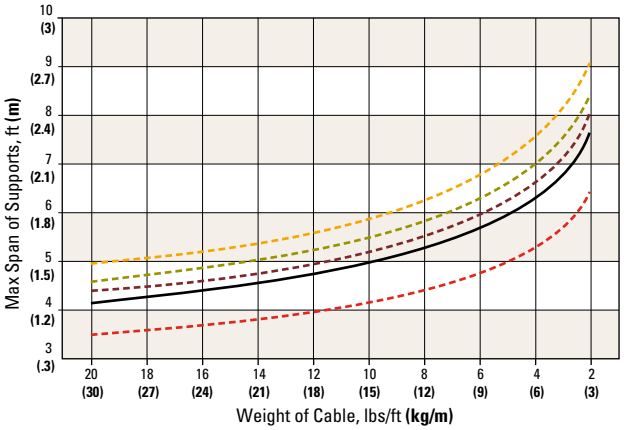
Deflection

Deflection is always determined at mid-span.

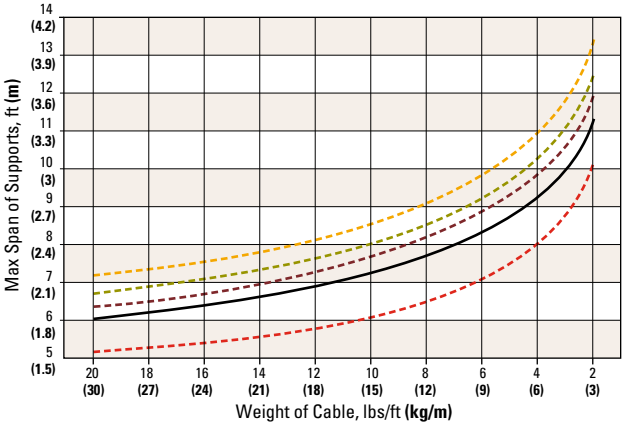
3/4" SW DIAMETER



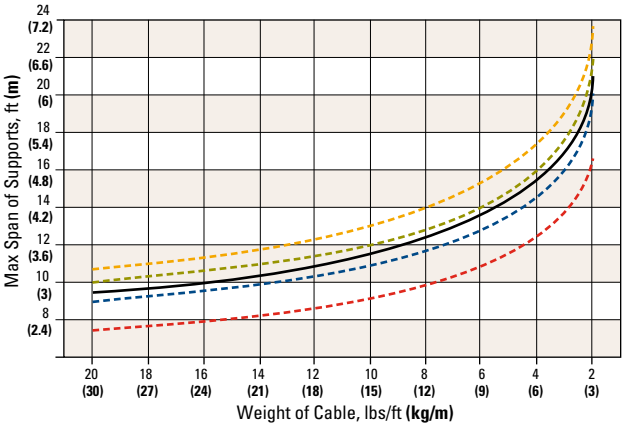
1" SW DIAMETER



2" SW DIAMETER



2" XW DIAMETER



Legend:

- 1/4" (6) Deflection
- 1/2" (13) Deflection
- 5/8" (16) Deflection
- 3/4" (19) Deflection
- 1" (25) Deflection

The empirical formula for deflection is:

$$D = \frac{131 \times W \times L^4}{E(OD^4 - ID^4)}$$

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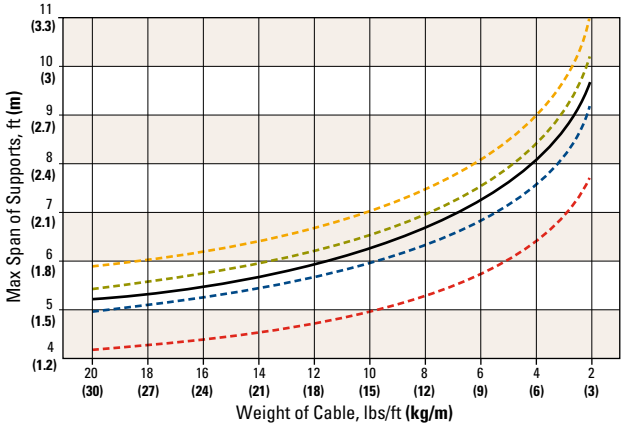
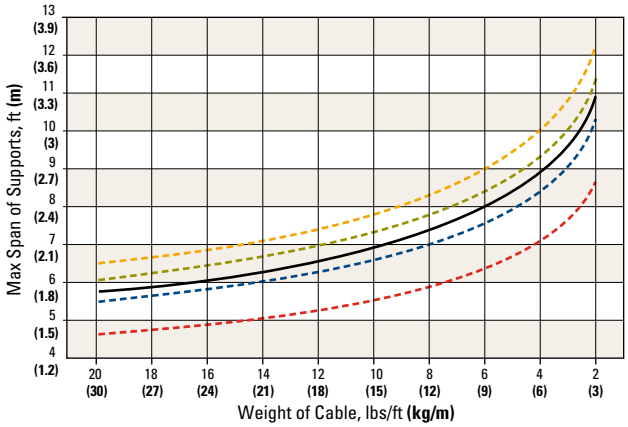
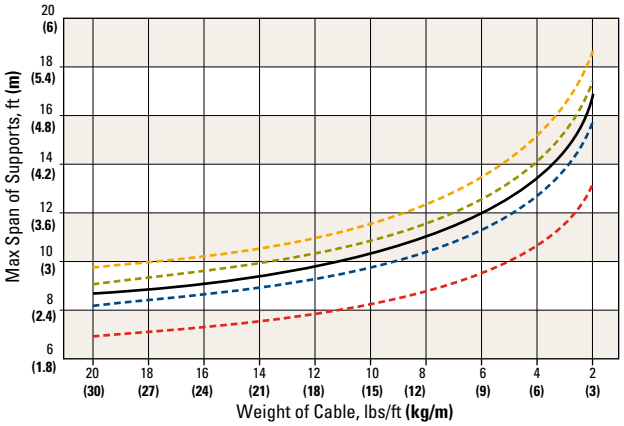
1-1/4" SW DIAMETER



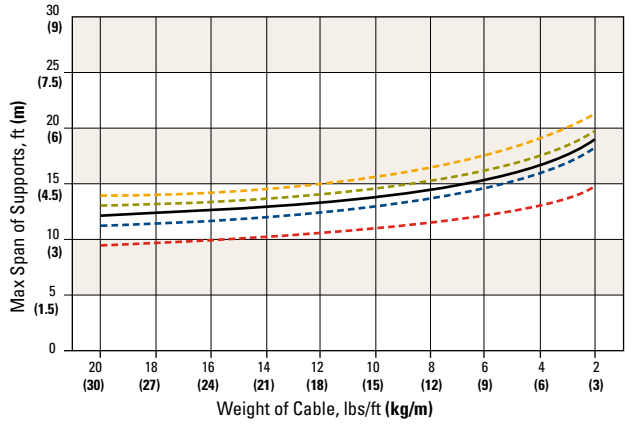
1-1/2" SW DIAMETER



3" SW DIAMETER



3" XW DIAMETER



D = Mid-span deflection (in)

OD = Outside diameter of conduit (in)

ID = Inside diameter of conduit (in)

E = Modulus of elasticity of conduit (psi), which is 1,400,000 for epoxy fiberglass conduit

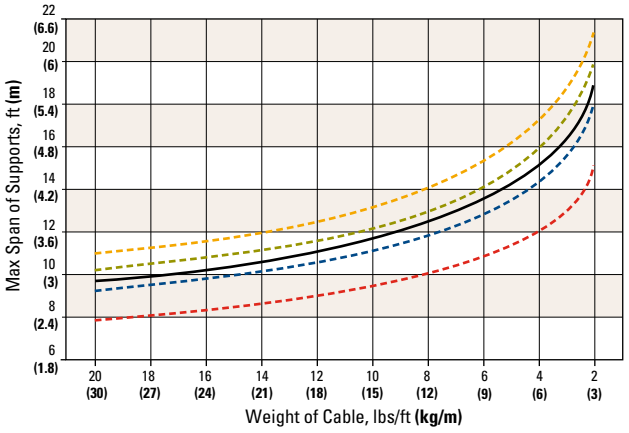
L = Distance between hangers (ft)

W = Total weight of cable and conduit (lbs/ft)

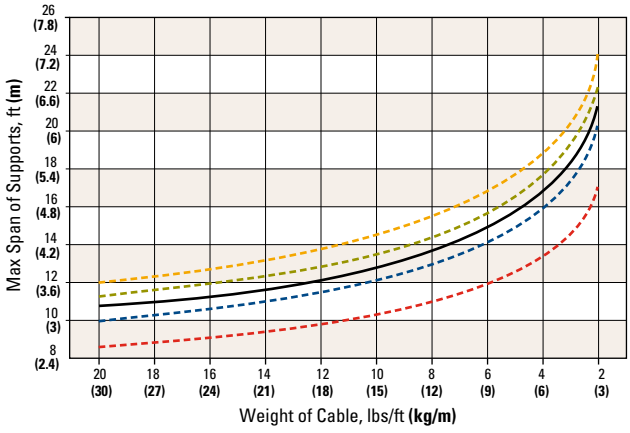
It is recommended that mid-span deflection never exceeds 5/8 in (16 mm).

Above and on the following three pages are easy graphs for determining support distance between hangers for various diameters and wall thicknesses of conduit.

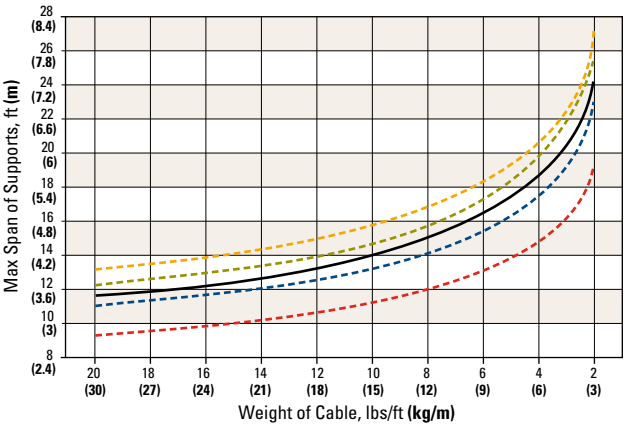
3-1/2" SW DIAMETER



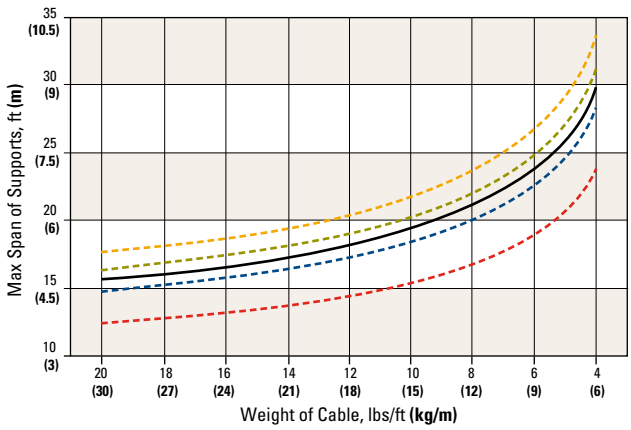
4" SW DIAMETER



4" HW DIAMETER



4" XW DIAMETER



Legend:

1/4" (6) Deflection

1/2" (13) Deflection

5/8" (16) Deflection

3/4" (19) Deflection

1" (25) Deflection

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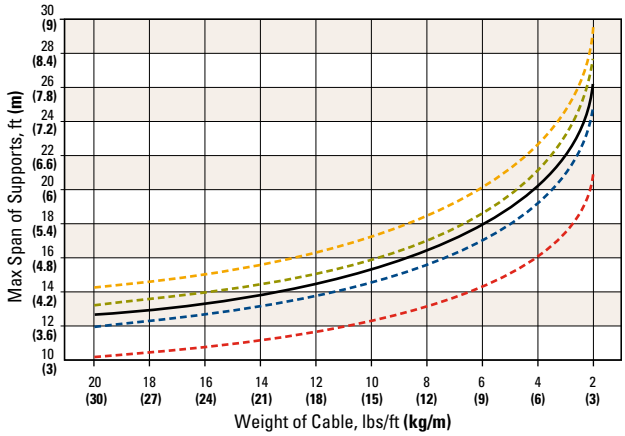
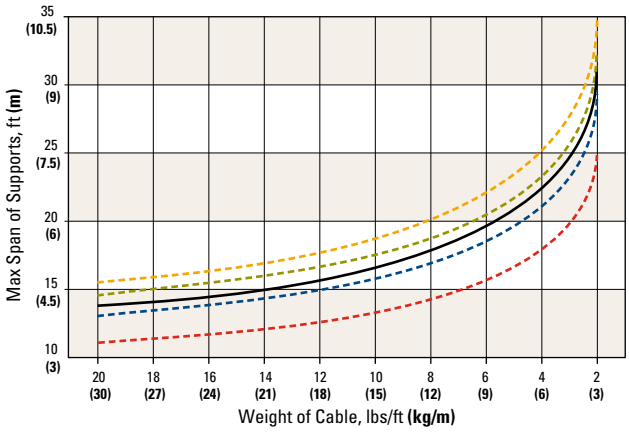
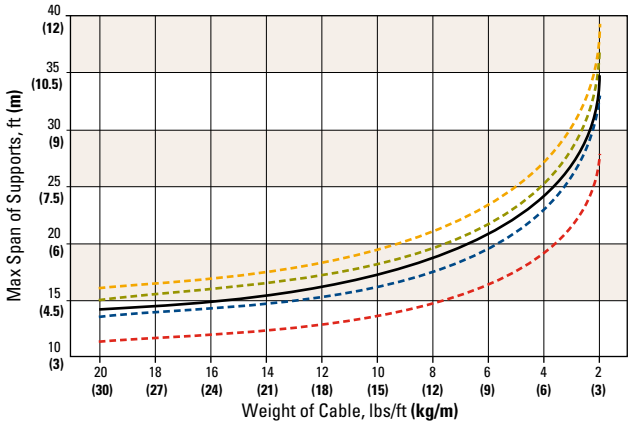
5" SW DIAMETER



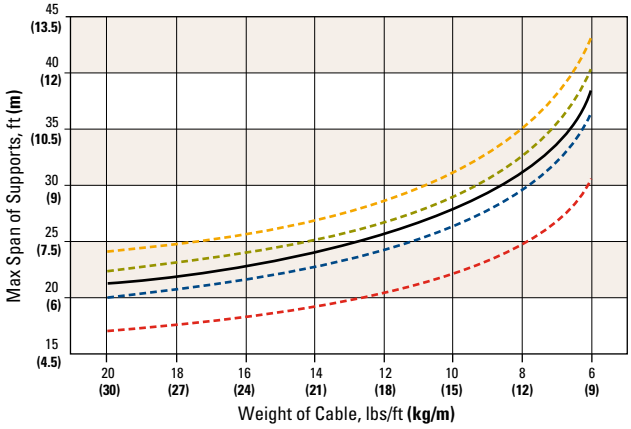
5" MW DIAMETER



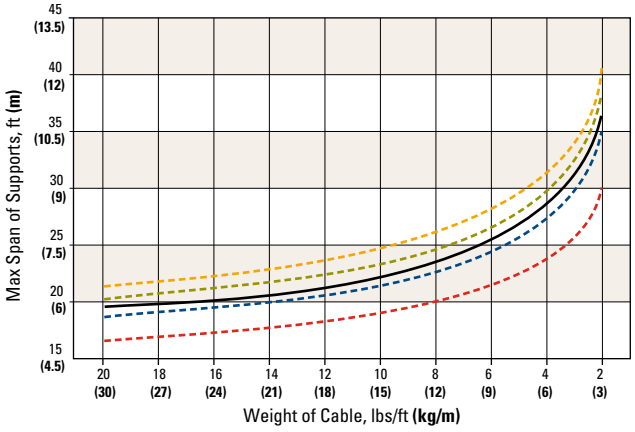
5" HW DIAMETER



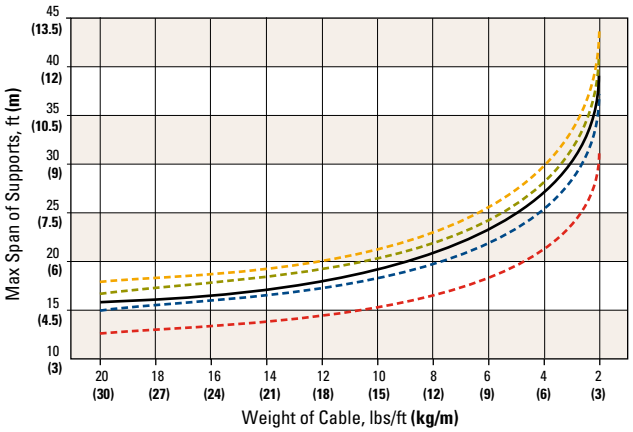
5" XW DIAMETER



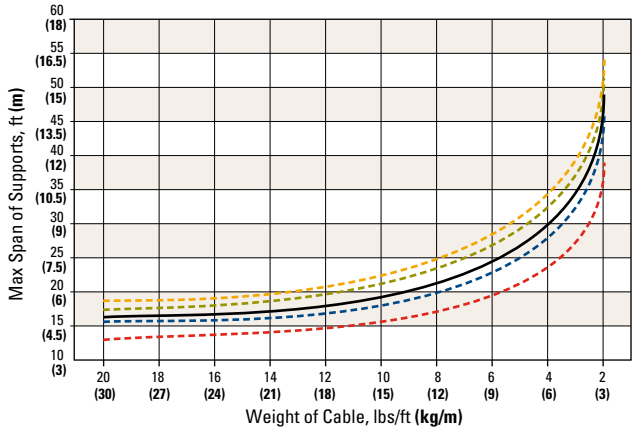
6" SW DIAMETER



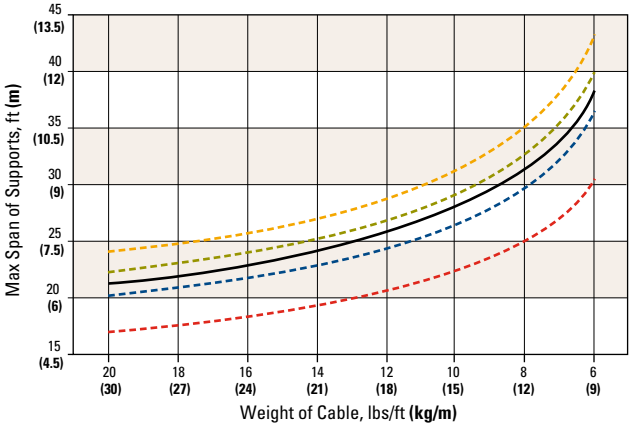
6" MW DIAMETER



6" HW DIAMETER



6" XW DIAMETER



Legend:

1/4" (6) Deflection

1/2" (13) Deflection

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Corrosion Resistance Guide

The corrosion guidelines tests were performed by immersing epoxy coupons for 30 days in the chemical at the temperatures shown. This is a very severe test. It has been shown that Champion Duct® can often be used for chemicals listed as "Not Recommended" (NR) as real cases often are limited to fumes, vapors and occasional splashes at the temperatures indicated.

This information is provided solely as a guide since it is impossible to anticipate all individual site conditions. For specific applications which are not covered in this guide, and may require screening tests to evaluate resin system suitability, consultation with Champion Fiberglass is recommended.

UP TO TEMPERATURE, °F	EPOXY CONDUIT	
CHEMICAL	120°	210°
Acetaldehyde	N	N
Acetaldehyde, aq. 40%	N	N
Acetic Acid, glacial	N	N
Acetic Acid, 20% (25)	R	C
Acetic Acid, 80%	N	N
Acetic Anhydride	N	N
Acetone, 10%	N	N
Adipic Acid	C	N
Alcohol, allyl	N	N
Alcohol, benzyl	N	N
Alcohol, butyl (n-butanol)	C	N
Alcohol, butyl (2-butanol)	N	N
Alcohol, ethyl	C	N
Alcohol, hexyl	R	C
Alcohol, isopropyl (2-propanol)	C	N
Alcohol, methyl	N	N
Alcohol, propy (1-propanol)	R	N
Allyl chloride	N	N
Alum	R	C
Ammonia, gas	C	N
Ammonia, liquid	N	N
Ammonia, aq. 20%	–	–
Ammonia salts, except fluoride	R	C
Ammonia fluoride, 25%	R	N
Amyl acetate	N	N
Amyl chloride	R	N
Aniline	N	N
Aniline hydrochloride	R	N
Antimony trichloride	–	–
Aqua regia	–	–
Arsenic Acid, 80%	C	N
Aryl-sulfonic acid	R	R
Barium salts	R	C
Beer	C	N
Beet sugar liquor	R	N
Benzaldehyde, 10%	–	–
Benzaldehyde, 10–100%	N	N
Benzene (benzoil)	C	N
Benzene sulfonic acid, 10%	R	R
Benzene sulfonic acid, 50%	C	N
Benzoic acid	R	R
Black liquor–paper	R	C
Bleach, 12.5% active chlorine	C	N
Bleach, 5.5% active chlorine	C	N
Borax	R	R
Boric acid	R	R
Brine	R	N
Bromic acid, <50%	N	N

UP TO TEMPERATURE, °F	EPOXY CONDUIT	
CHEMICAL	120°	210°
Bromine, liquid	N	N
Bromine, gas, 25%	N	N
Bromine, aq.	N	N
Butane	R	R
Butanterol (erythriol)	–	–
Butanediol	–	–
Butyl Acetate	N	N
Butyl phenol	N	N
Butyric acid <50%	R	R
Calcium salts, aq.	R	R
Calcium hypochlorite	C	N
Calcium hydroxide, 100%	R	R
Cane sugar liquors	R	N
Carbon disulfide	N	N
Carbon dioxide	C	C
Carbon dioxide, aq.	C	C
Carbon monoxide	R	C
Carbon tetrachloride	R	N
Casein	R	R
Castor oil	R	N
Caustic potash (KOH)	C	N
Caustic soda (NaOH)	C	N
Chlorine, gas, dry	R	C
Chlorine, gas, wet	N	N
Chlorine, liquid	N	N
Chlorine, water	C	N
Chlorocetic acid	R	N
Chlorobenzene	N	N
Chloroform	N	N
Chlorosulfonic acid, 10%	N	N
Chromic acid, 10%	N	N
Chromic acid, 30%	N	N
Chromic acid, 40%	N	N
Chromic acid, 50%	N	N
Citric acid	R	R
Coconut oil	R	N
Copper salts, aq.	R	R
Corn oil	R	C
Corn syrup	R	R
Cottonseed oil	R	R
Cresylic acid, 50%	N	N
Crude oil	R	R
Cyclohexane	R	N
Cyclohexanol	R	N
Cyclohexanone	–	–
Diesel fuels	R	N
Diethyl amine	N	N
Dioctyl phthalate	R	C

UP TO TEMPERATURE, °F	EPOXY CONDUIT	
CHEMICAL	120°	210°
Dioxane – 1,4	–	–
Dimethylamine	N	N
Dimethyl formamide	N	N
Detergents, aq.	R	R
Disbutylphthalate	R	N
Dibutyl sebacate	R	N
Dichlorobenzene	N	N
Dichlorethylene	N	N
Ether (diethyl)	N	N
Ethyl halides	N	N
Ethylene halides	N	N
Ethylene glycol	R	R
Ethylene oxide	N	N
Fatty acids	C	R
Ferric salts	R	R
Fluorine, gas, dry	N	N
Fluorine. gas, wet	N	N
Fluoroboric acid, 25%	R	R
Fluoroboric acid, 10%	C	N
Formaldehyde	C	N
Formic acid	C	N
Freon, F11, F12, 113, 114	N	N
Freon, F21, F22	N	N
Fruit Juices and pulps	N	N
Fuel oil	R	C
Furfural	N	N
Gas, natural, methane	R	N
Gasoline	N	N
Gelatin	R	N
Glycerine (glycerol)	R	R
Glycols	R	C
Glycolic acid	C	N
Green Liquor–paper	R	N
Heptane	R	R
Hexane	R	N
Hydrobromic acid, 25%	C	N
Hydrobromic acid	C	N
Hydrofluoric acid, 10%	R	N
Hydrofluoric acid, 60%	N	N
Hydrofluoric acid, 100%	N	N
Hydrocyanic acid	–	–
Hydrogen peroxide, 50%	N	N
Hydrogen peroxide, 90%	N	N
Hydrogen sulfide, dry	R	R
Hydrazine	N	N
Hypochlorous acid, 10%	N	N
Jet fuels, JP 4 and JP5	R	N
Kerosene	R	N

R = Generally resistant N = Generally not resistant C = Less resistant than "R" but still suitable for some conditions

Champion Engineering Specifications *cont.*

UP TO TEMPERATURE, °F	EPOXY CONDUIT	
CHEMICAL	120°	210°
Lauric acid	R	R
Lauryl chloride	R	R
Lauryl sulfate	R	R
Lead salts	R	R
Linoleic acid	R	N
Linseed oil	R	R
Lithium salts	R	R
Lubricating oils	R	N
Machine oil	R	N
Magnesium salts	R	R
Maleic acid	R	R
Manganese sulfate	R	R
Mercuric salts	R	R
Mercury	R	R
Methane	R	R
Methyl acetate	N	N
Methyl bromide (gas)	N	N
Methyl cellosolve	–	–
Methyl chloride	N	N
Methyl chloroform	N	N
Methyl cyclohexanone	N	N
Methyl methacrylate	N	N
Methylene bromide	N	N
Methylene chloride	N	N
Methylene iodide	N	N
Milk	R	R
Mineral oil	R	R
Molasses	R	N
Monochlorozenzene	N	N
Monoethanolamine	N	N
Motor oil	R	R
Naphtha	R	N
Naphthalene	R	R
Nickel salts	R	R
Nitric acid, 0 to 20%	N	N
Nitric acid, 21 to 100%	N	N
Nitric acid, fuming	N	N
Nitrobenzene	N	N
Nitrous acid	R	N
Oleic acid	R	R
Oleum	N	N
Olive oil	R	R
Oxalic acid	R	R
Ozone, gas, 5%	C	N
Palmitic acid, 10%	R	R
Palmitic acid, 70%	R	R
Paraffin	R	R

UP TO TEMPERATURE, °F	EPOXY CONDUIT	
CHEMICAL	120°	210°
Perchloric acid, 10%	R	C
Perchloric acid, 70%	R	C
Perchloroethylene	R	C
Petroleum, sour	R	R
Petroleum, refined	R	R
Phenol, 88%	N	N
Phenylcarbinol	N	N
Phenylhydrazine	N	N
Phosphoric acid	C	R
Phosphorous, yellow	N	N
Phosphorous, red	N	N
Phosphorous trichloride	N	N
Phthalic acid	R	R
Potassium salts, aq.	R	R
Potassium permanganate, 25%	C	C
Propane	R	R
Propylene dichloride	N	N
Propylene glycol	R	R
Propylene oxide	N	N
Pyridine	N	N
Rayon coagulating bath	R	N
Sea water	R	R
Salicylic acid	R	N
Sewage, residential	C	N
Silicic acid	R	R
Silicone oil	R	R
Silver salts	R	R
Soaps	R	R
Sodium hydroxide	N	N
Sodium salts, aq. Except	R	C
Sodium chlorite, 10%	R	N
Sodium chlorate	R	R
Sodium dichromate, acid	R	R
Stannic chloride	R	R
Stannous chloride	R	R
Stearic acid	R	R
Sulfite liquor	R	C
Sulfur	R	N
Sugars, aq.	R	R
Sulfur dioxide, dry	R	R
Sulfur dioxide, wet	C	C
Sulfur trioxide, gas, dry	R	R
Sulfur trioxide, gas, wet	N	N
Sulfuric acid, < 26%	R	N
Sulfuric acid, 26 to 80%	C	N
Sulfuric acid, 81 to 100%	N	N
Sulfuric acid, 10%	R	N

UP TO TEMPERATURE, °F	EPOXY CONDUIT	
CHEMICAL	120°	210°
Tannic acid	R	R
Tartaric acid	R	R
Tetrachloroethane	C	N
Tetrahydrofuran	N	N
Thionyl chloride	N	N
Thread cutting oil	R	N
Terpineol	R	R
Toluene	C	N
Tributyl phosphate	R	N
Tricresyl phosphate	R	N
Trichloracetic acid	C	C
Trichloroethylene	N	N
Triethanolamine	R	N
Triethylamine	C	N
Turpentine	R	N
Urea, 50%	R	N
Urine	R	N
Vaseline	R	R
Vegetable oils	R	R
Vinegar	R	R
Vinyl acetate	N	N
Water, distilled	C	N
Water, fresh	R	N
Water, mine	R	N
Water, salt	R	N
Water, tap	R	N
Whiskey	R	N
Wines	R	C
Xylene	C	N
Zinc salts	R	R

R = Generally resistant N = Generally not resistant C = Less resistant than "R" but still suitable for some conditions

- Temperatures represent standard test conditions and are not minimums or maximums. Champion Duct products may be acceptable at other temperatures for some chemicals, but should be tested to determine specific suitability.
- The recommendations or suggestions contained in this table are made without guarantee or representation as to results. We suggest that you evaluate these recommendations and suggestions in your own laboratory or field trial prior to use.

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